

Remarks

Reconsideration and withdrawal of the rejection set forth in the above-mentioned Official Action in view of the foregoing amendments and the following remarks are respectfully requested.

Initially, Applicants request that the Examiner consider the documents cited in the Information Disclosure Statement filed September 24, 2003, and indicate such consideration by initialing and returning a copy of the Form PTO-1449 provided therewith.

Claims 1, 3-10 and 12-18 remain pending in the application, with Claims 1 and 10 being independent. Claims 1 and 10 have been amended herein.

Claims 1, 3-10 and 12-18 were rejected under 35 U.S.C. § 103 as being unpatentable over European Patent Application No. 0 496 533 (Yano et al.) in view of U.S. Patent No. 6,109,734 (Kashino et al.). This rejection is respectfully traversed.

As is recited in independent Claim 1, the present invention relates to a method of filling a buffer portion in a print head with at least one bubble, using a print head comprising a plurality of ejection openings through which ink is ejected, a plurality of channels that are each in communication with a corresponding one of the plurality of ejection openings, a common liquid chamber for supplying ink to the plurality of channels, a buffer portion located at an end of an arrangement direction of the channels and adjoining, in the arrangement direction of the channels, at least one of the channels in communication with at least one corresponding ejection opening to restrain vibration of ink in the common liquid chamber which occurs as a result of ejection of the ink, and bubble generating means for filling the buffer portion with at least one bubble. The method

includes the steps of filling the buffer portion with the at least one bubble by driving the bubble generating means and executing a recovery process of discharging the ink through the ejection openings after the bubble filling step. In the recovery process step, excess of the at least one bubble filled in the buffer portion is removed.

As is recited in independent Claim 10, the present invention relates to a printing apparatus able to print an image on a printing medium, using a print head comprising a plurality of ejection openings through which ink is ejected, a plurality of channels that are each in communication with a corresponding one of the plurality of ejection openings, a common liquid chamber for supplying ink to the plurality of channels, a buffer portion located at an end of an arrangement direction of the channels and adjoining, in the arrangement direction of the channels, at least one of the channels in communication with at least one corresponding ejection opening to restrain vibration of ink in the common liquid chamber which occurs as a result of ejection of the ink, and bubble generating means for filling the buffer chamber with at least one bubble. The apparatus includes recovery process means which causes the ink to be discharged through the ejection openings. The recovery process means causes the ink to be discharged through the ejection openings after the bubble generating means has filled the buffer portion with at least one bubble, and discharges the ink through the ejection openings to remove excess of the at least one bubble.

With the above arrangement, because the buffer portion is located at an end of an arrangement direction of the channels and adjoining, in the arrangement direction of the channels, at least one of the channels in communication with at least one corresponding

ejection opening, any bubble or portion of a bubble that overflows from the buffer portion can be quickly removed through the adjoining channel in the recovery process. Thus, the printing operation would not be adversely affected.

As described previously, the ink jet printer of Yano et al. introduces air bubbles in an ink chamber to function as buffers. The buffers can absorb discharge energy in the form of pressure waves directed toward the common liquid chamber so that refilling after discharge can be quickly performed. Yano et al., however, does not disclose or suggest at least a buffer portion located at an end of an arrangement direction of channels and adjoining, in the arrangement direction of the channels, at least one of the channels in communication with at least one corresponding ejection opening, as is recited in independent Claims 1 and 10.

Thus, Yano et al. fails to disclose or suggest important features of the present invention recited in the independent claims.

Kashino et al. relates to an ink jet head having a buffer chamber that can absorb back-pressure waves. In the embodiment of Fig. 8, bubble cells 306 are formed with partition walls 312 separating the cells from common liquid chamber 302. However, Applicants respectfully submit that the communicating portion 307 of each of the bubble cells 306 opens toward the side of the common liquid chamber 302 not toward a location adjoining a channel 303 in the arrangement direction of the channels (column 11, lines 55-67). Therefore, any bubbles or portions of bubbles retained in the common liquid chamber that have overflowed from the bubble cells 306 are difficult to remove. The bubble cells 306 of Kashino et al. cannot be said to adjoin, in the arrangement direction of the channels,

at least one of the channels. Therefore, Kashino et al. is not believed to remedy the deficiencies of Yano et al. noted above with respect to independent Claims 1 and 10.

Thus, independent Claims 1 and 10 are patentable over the citations of record. Reconsideration and withdrawal of the § 103 rejection are respectfully requested.

For the foregoing reasons, Applicants respectfully submit that the present invention is patentably defined by independent Claims 1 and 10. Dependent Claims 3-9 and 12-18 are also allowable, in their own right, for defining features of the present invention in addition to those recited in their respective independent claims. Individual consideration of the dependent claims is requested.

Applicants submit that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the rejection set forth in the above-noted Office Action, and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,


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